

Patent Claims

1. A method for electroplating,
having the following steps:
- 5 application of an electrically conductive basic layer
(22) to a substrate (12),
application of an auxiliary layer (24) having better
electrical conductivity in comparison with the basic
layer (22) after the application of the basic layer
10 (22),
application of a mask layer (26) after the application
of the auxiliary layer (24),
production of a mask with at least one mask opening
(28) from the mask layer (26),
15 patterning of the auxiliary layer (24) using the mask,
the basic layer (22) not being patterned or not being
completely patterned according to the mask,
electroplating of at least one layer (50, 52) in the
mask opening (28) after the patterning of the auxiliary
20 layer (24),
namely:
electroplating of a base layer (50),
electroplating of a covering layer (52) after the
electroplating of the base layer (50), the base layer
25 (50) comprising a different material than the covering
layer (52).
2. The method as claimed in claim 1, characterized by
the following steps:
- 30 electroplating with a current density in an initial
phase,
electroplating with a higher current density in
comparison with the current density during the initial
phase in a main phase following the initial phase.
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3. The method as claimed in claim 1 or 2,
characterized in that the current density in the

initial phase has a value of less than 50 percent of the current density in the main phase,
and/or in that the initial phase is longer than 5 seconds and/or shorter than 5 minutes,

- 5 and/or in that the current density in the main phase is greater than 0.2 ampere per square decimeter and/or less than 10 amperes per square decimeter.

4. The method as claimed in one of the preceding
10 claims, characterized by the following steps:
application of an insulating layer (18) prior to the application of the basic layer (22),
patterning of the insulating layer (18) with production of a contact opening (20) prior to the application of
15 the basic layer (22),
and preferably application of a part of the basic layer (22) in the contact opening (20).

5. The method as claimed in one of the preceding
20 claims, characterized in that the basic layer (22) is a barrier layer against copper diffusion,
and in that the auxiliary layer (24) contains copper or comprises copper.

- 25 6. The method as claimed in one of claims 1 to 4, characterized in that the basic layer (22) is a barrier layer against copper diffusion,
and in that the auxiliary layer (24) comprises copper.

- 30 7. The method as claimed in claim 6, characterized in that the material of the base layer (50) has a melting point of greater than 500 degrees Celsius,
and in that the material of the covering layer (52) has a melting point of less than 400 degrees Celsius.

- 35 8. The method as claimed in one of the preceding claims, characterized in that the patterning of the auxiliary layer is carried out by means of a galvanic

method, preferably in the same installation as the electroplating of the layer (50, 52) in the mask opening (28).

5 9. A copper-free contact projection arrangement (10),
which contains in the following order with increasing
distance from a substrate (12) of an integrated
circuit:
an electrically conductive interconnect (16) or
10 connection plate,
an electrically conductive basic layer (22),
adjoining the basic layer (22) a copper-free base layer
(50) made of a material having a melting point of
greater than 500 degrees Celsius,
15 an electrically conductive solder material layer (52)
having a melting point of less than 400 degrees
Celsius,
the base layer (50) comprising nickel or nickel-
phosphorus, or containing at least 60 atomic percent of
20 nickel,
the basic layer (22) forming a diffusion barrier for
copper,
the basic layer (22) comprising titanium-tungsten,
titanium nitride or tantalum nitride or containing
25 titanium-tungsten, titanium nitride or tantalum
nitride,
and the basic layer (22) adjoining the interconnect
(16) or the connection plate.

30 10. The contact projection arrangement (10) as claimed
in claim 9, characterized in that a boundary layer made
of binary or multiphase compounds, in particular made
of a ternary compound, is present at the boundary
between base layer (50) and solder material layer (52).

35 11. The contact projection arrangement (10) as claimed
in claim 9 or 10, characterized in that the
interconnect (16) or the connection plate contains at

least 80 atomic percent of aluminum, or in that the interconnect (16) or the connection plate contains more than 50 atomic percent of copper, and/or in that the solder material layer (52) comprises a tin alloy, in particular a tin-silver alloy or a tin-lead alloy or a tin-silver-copper alloy or a tin-silver-bismuth alloy, or contains a tin alloy, in particular a tin-silver alloy or a tin-lead alloy or a tin-silver-copper alloy or a tin-silver-bismuth alloy, and/or in that the basic layer contains a layer stack made of a plurality of component layers, the layer stack containing at least one of the following layers: a titanium layer, a tantalum layer, a titanium nitride layer, a tantalum nitride layer, a tungsten layer, a titanium-tungsten layer or a titanium-tungsten nitride layer.

12. The contact projection arrangement (10) as claimed in claim 9 or 10, characterized in that the basic layer (22) comprises titanium-tungsten or contains titanium-tungsten, the proportion of titanium being less than 20 atomic percent.

13. The contact projection arrangement (10) as claimed in one of claims 9 to 12, characterized in that the base layer (50) adjoins the solder material layer (52).

14. The contact projection arrangement (10) as claimed in one of claims 9 to 13, characterized by an electrically insulating layer (18) with a cutout (20) in which at least part of the basic layer (22) and part of the base layer (50) are arranged.